To: T10 Technical Committee
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Subject: SAT2 Translation of Large Physical Blocks

Revision History
Revision 0 (May 3, 2007) First revision

Related Documents
sat-r09 - SCSI/ATA Translation (SAT) revision 9
sat2r01 - SCSI/ATA Translation (SAT-2) revision 0
sbc3r09 - SCSI Block Commands - 3 (SBC-3) revision 9
ata8-acs-r3g - AT Attachment 8 - ATA/ATAPI Command Set (ATA8-ACS) revision 3g

Overview
ATA8-ACS defines how an ATA device reports its geometry of logical and physical
sectors. SBC-3 defines how a SCSI device server reports similar information. This
proposal describes how to map these geometry parameters between ATA and SCSI.

Some additional text in SAT is cleaned-up, and SBC-3 replaces SBC-2 as the reference
document.

Suggested Changes

Modify
3.1.   Definitions
9.AA.   READ CAPACITY(16) command

2.2 Approved references
~~ISO/IEC 14776-322, SCSI Block Commands - 2 (SBC-2) [ANSI INCITS 405-2005]~~

2.3 References under development
At the time of publication, the following referenced standards were still under development. For
information on the current status of the document, or regarding availability, contact the relevant
standards body or other organization as indicated.

ISO/IEC 14776-323, SCSI Block Commands - 3 (SBC-3) [T10/1799-D]

Editor's Note 1: Update all SBC-2 references to SBC-3. Include editor's notes wherever new
fields are defined in SBC-3 that need to be considered in SAT-2.

<u>Add these definitions</u>
3.1.XX ATA logical sector alignment: The logical sector alignment is returned in ATA IDENTIFY DEVICE data word (209), bits 13:0, if word 209, bit 15 is set to zero and bit 14 is set to one; otherwise, it is assumed to be zero.

3.1.YY ATA logical sectors per physical sector exponent: The number of logical sectors per physical sector (expressed as a power of 2) is returned in ATA IDENTIFY DEVICE data word (106), bits 3:0, if word 106, bit 15 is set to zero and bit 14 is set to one and bit 13 is set to one; otherwise, it is assumed to be zero.

9 SCSI Block Commands (SBC) mapping

9.1 Translating LBA and transfer length and ATA command use constraints

9.1.1 Overview
A SATL may implement a direct logical block mapping of ATA logical sectors to SCSI logical blocks (see 9.1.2), or the SATL may implement indirect logical block mapping translation (see 9.1.3).

9.1.2 Direct logical block mapping model
If the SATL implements direct logical block mapping (see 3.1.33), the logical block size indicated by the BLOCK LENGTH IN BYTES field in the READ CAPACITY data (see 9.8.2 and 9.9.2) shall equal the ATA logical sector Size (see 3.1.15). The ATA LBA of an ATA logical sector shall equal the logical block address of the corresponding SCSI logical block.

9.1.3 Indirect logical block mapping model
If the SATL implements indrect logical block mapping (see 3.1.38), the constraints of the direct logical block mapping model do not apply. The logical block size indicated by the BLOCK LENGTH IN BYTES field in the READ CAPACITY data (see 9.8.2 and 9.9.2) may not equal the ATA logical sector size (see 3.1.15) (e.g., SCSI logical block size of 520 bytes with an ATA Logical Sector Size of 512 bytes). The SATL translates between the SCSI LOGICAL BLOCK ADDRESS field and the ATA LBA in a vendor-specific manner. The result of a logical block address translated in one direction and then translated in the reverse direction shall yield the original logical block address.

Editor's Note 2: Globally change "direct block mapping" to "direct logical block mapping" and "indirect block mapping" to 'indirect logical block mapping"

9.8 READ CAPACITY (10) command

9.8.1 READ CAPACITY (10) command overview

The READ CAPACITY (10) command (see SBC-2) requests that the device server transfer eight bytes of parameter data describing the capacity and medium format of the direct-access block device to the application client. Table 34 shows the translation for fields specified in the READ CAPACITY (10) CDB.

Table 34 — READ CAPACITY (10) CDB field translations

Field	Description or reference
OPERATION CODE	Set to 25h. The SATL shall use ATA IDENTIFY DEVICE data to compute the ATA device's maximum user addressable medium capacity of the ATA device.
LOGICAL BLOCK ADDRESS	If the LOGICAL BLOCK ADDRESS field is not set to zero the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
PMI	If the PMI bit is not set to zero the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
CONTROL	6.4

Editor's Note 3: Globally change "This field is otherwise" to "Otherwise, this field" to improve consistency.

Editor's Note 4: Globally change "Otherwise the XYZ field" to "Otherwise, this field" to improve consistency.

9.8.2 READ CAPACITY (10) parameter data

The SATL shall return READ CAPACITY (10) parameter data as defined by SBC-23. Table 35 describes the translation of fields in the READ CAPACITY (10) parameter data.

Table 35 - READ CAPACITY(10) translations

Field	Description or reference
RETURNED LOGICAL BLOCK ADDRESS [a]	If the SATL implements direct logical block mapping (see 3.1.33), the device server shall set the RETURNED LOGICAL BLOCK ADDRESS field to the lower of a) the ATA maximum LBA (see 3.1.16) or b) FFFF_FFFFh If the value is FFFF_FFFFh, the If the number of logical blocks exceeds the maximum value that is able to be specified in the RETURNED LOGICAL BLOCK ADDRESS field, the device server shall set the RETURNED LOGICAL BLOCK ADDRESS field to FFFFFFFFh. The application client should then issue a READ CAPACITY (16) command (see 9.9) to retrieve the READ CAPACITY (16) parameter data. Otherwise, this field is This field is otherwise unspecified (see 3.4.2).

LOGICAL BLOCK LENGTH IN BYTES [a]	If the SATL implements direct logical block mapping (see 3.1.33) then the BLOCK LENGTH IN BYTES field shall contain the ATA logical sector size (see 3.1.15). Otherwise, ~~the BLOCK LENGTH IN BYTES~~ this field is unspecified (see 3.4.2).
[a] The values reported in the RETURNED LOGICAL BLOCK ADDRESS field and the BLOCK LENGTH IN BYTES field shall be such that the logical unit capacity (see 3.1.49) is less than or equal to the ATA device capacity (see 3.1.9).	

Editors Note 5: (Global): The SATL must parse each ATA field understanding the endianness with which it is defined, and preserve the value when copying the field into a SCSI field.

9.9 READ CAPACITY(16) command

9.9.1 READ CAPACITY (16) command overview

The READ CAPACITY (16) command (see SBC-~~2~~3) requests that the device server transfer parameter data describing the capacity and medium format of the direct-access block device to the application client. Table 36 shows the translation for fields specified in the READ CAPACITY (16) CDB.

Table 36 — READ CAPACITY (16) CDB field translations

Field	Description or reference
OPERATION CODE/SERVICE ACTION	Set to 9E~~h~~/10h. The SATL shall use ATA IDENTIFY DEVICE data to compute the ATA device's maximum user addressable medium capacity of the ATA device.
LOGICAL BLOCK ADDRESS	~~If the LOGICAL BLOCK ADDRESS field is not set to zero the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.~~ As defined in READ CAPACITY (10) (see 9.8)
PMI	~~If the PMI bit is not set to zero the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.~~ As defined in READ CAPACITY (10) (see 9.8)
ALLOCATION LENGTH	The SATL shall implement this field as defined in SBC-3 (see 3.1.2)
CONTROL	6.4

9.AA.1 READ CAPACITY(16) parameter list

The READ CAPACITY(16) command shall return data obtained from the ATA IDENTIFY DEVICE command.

Table 37 - READ CAPACITY(16) translations

Field	Description or reference
RETURNED LOGICAL BLOCK ADDRESS [a]	The device server shall set the RETURNED LOGICAL BLOCK ADDRESS field to the ATA maximum LBA (see 3.1.16) ~~The maximum value that shall be returned in the RETURNED LOGICAL BLOCK ADDRESS field is FFFFFFFF_FFFFFFFFh. This field is otherwise unspecified (see 3.4.2).~~
LOGICAL BLOCK LENGTH IN BYTES [a]	If the SATL implements direct logical block mapping (see 3.1.33) then the LOGICAL BLOCK LENGTH IN BYTES field shall contain the ATA logical sector size (see 3.1.15). Otherwise~~,~~ ~~the BLOCK LENGTH IN BYTES~~ this field is unspecified (see 3.4.2).
~~RTO_EN~~	~~SBC-2: Unspecified (see 3.4.2)~~
PROT_EN	Unspecified (see 3.4.2)
P TYPE	Unspecified (see 3.4.2)

LOGICAL BLOCKS PER PHYSICAL BLOCK	If the SATL implements direct logical block mapping (see 3.1.33) then the LOGICAL BLOCKS PER PHYSICAL BLOCK field shall contain the ATA logical sectors per physical sector exponent (see 3.1.YY). Otherwise, this fiels is unspecified (see 3.4.2).
LOWEST ALIGNED LOGICAL BLOCK ADDRESS	If the SATL implements direct logical block mapping (see 3.1.33) then the LOWEST ALIGNED LOGICAL BLOCK ADDRESS field shall contain (w - (ATA logical sector alignment)) modulo w where: w = 2 ** LOGICAL BLOCKS PER PHYSICAL BLOCK Otherwise, this field is unspecified (see 3.4.2).
[a] The values reported in the RETURNED LOGICAL BLOCK ADDRESS field and the BLOCK LENGTH IN BYTES field shall be such that the logical unit capacity (see 3.1.49) is less than or equal to the ATA device capacity.	

TBD: (include examples of the translated values with offsets designed for MBR (LBA 63) and EFI (LBA 34) partitioned disks)